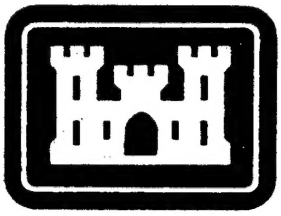
# EXECUTIVE SUMMARY

# ENERGY ENGINEERING ANALYIS PROGRAM
# FOR
# U.S. ARMY GARRISON, HONSHU, JAPAN

Prepared for:

## US Army Corps of Engineers

Pacific Ocean Divison





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# EXECUTIVE SUMMARY

## 1.0 INTRODUCTION

The purpose of the Energy Engineering Analysis (EEA) Program for the U.S. Army Garrison, Honshu (USAGH) installations is to develop a short-range Basewide Energy System Plan which includes policies and recommendations to systematically reduce energy consumption in compliance with the Army Facilities Energy Plan (AFEP). The USAGH, a subordinate command of U.S. Army, Japan (USARJ), has as its primary mission the support of all U.S. Army Units on Honshu. The four installations included in this study, Camp Zama, Sagamihara Dependent Housing Area (SDHA), Sagami General Depot and Yokohama North Dock (YND), are part of some one dozen installations under the command of USAGH.

The AFEP, dated 1 October 1978, established as the goal for USARJ a reduction in the average energy use per gross square foot of facility area by 20% using FY 75 as the base year. The average energy use in FY 75 was 167,700 Btu per square foot and therefore the FY 85 goal was 134,200 Btu per square foot.

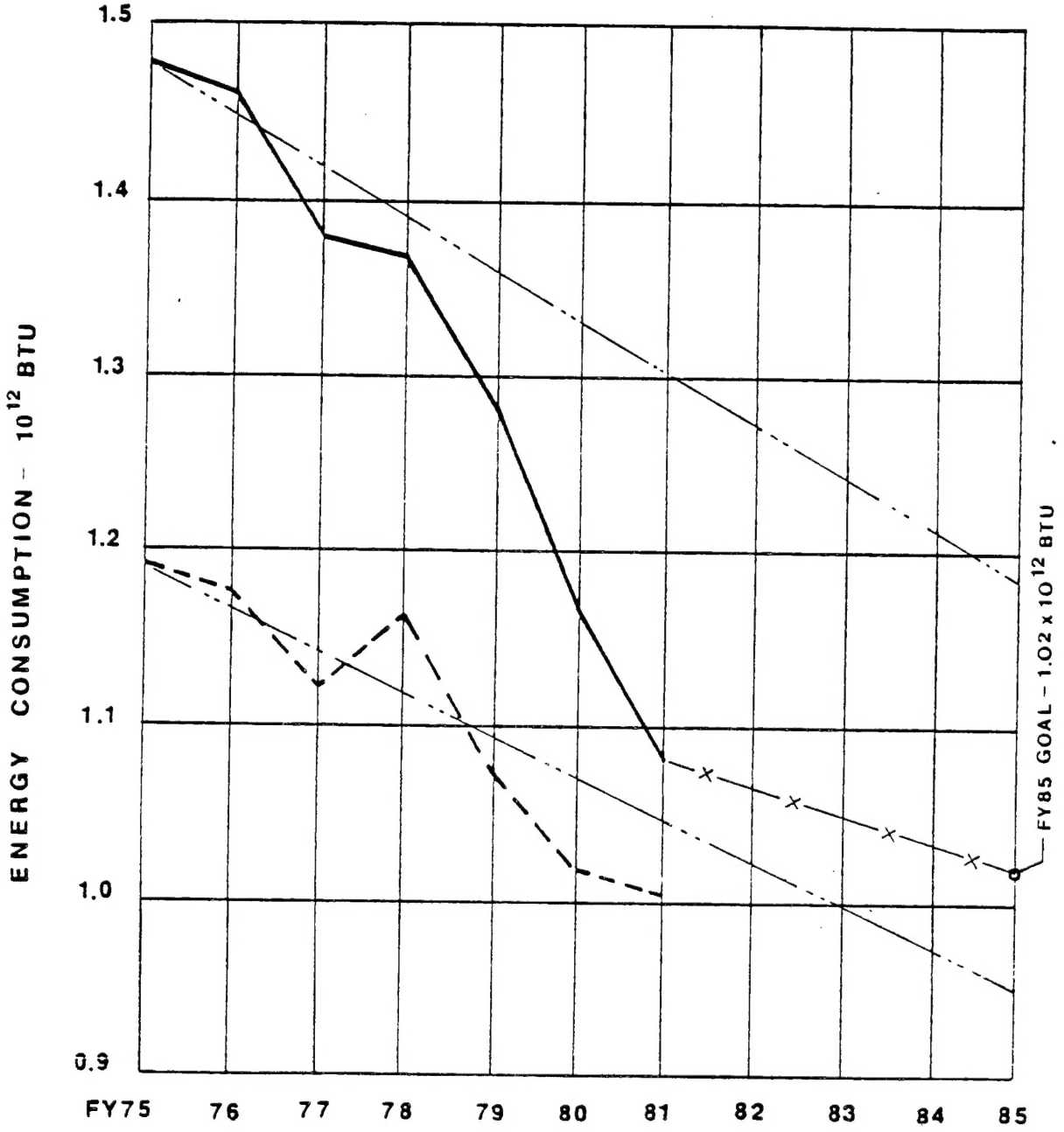
The AFEP, dated 15 October 1980, modified the goal previously expressed in Btu per gross square foot to total facilities energy consumption. The USARJ's goal was established at $1.5 \times 10^{12}$ Btu per year for FY 85. This was subsequently modified in the AFEP, dated 26 October 1981, with a further reduction to $1.2 \times 12^{12}$ Btu per year for FY 85. Based on this latest AFEP, USARJ has established the total facilities energy consumption goal for USAGH at 85% of the total for the Command, or $1.02 \times 10^{12}$ Btu per year.

Using FY 75 as the base year, the total energy consumption by all USAGH installations was 1,478,000 MBtu A 20% reduction of this consumption figure by FY 85 would be 1,182,000 MBtu. However, with the release of certain facilities, together with various energy conservation measures, the actual energy consumption by USAGH in FY 81 was approximately 1,080,000 MBtu. This would then be 60,000 MBtu above the currently established USAGH goal of 1,020,000 MBtu for FY 85. An average annual reduction of 1.5% per year during the next 4 years will permit USAGH to meet its FY 85 goal. (See Figure A.)

In FY 75, the total energy consumption by the four study bases was 1,191,000 MBtu which represented 81% of the total USAGH consumption. With the phasedown of some of the other facilities, the four study bases' share of the total consumption increased to over 90% in FY 81.

A careful review of the annual energy consumption by the four study bases will indicate that by using FY 80 and FY 81 consumption figures, these bases collectively are comfortably ahead of the goal of 2% per year reduction. Using the FY 81 consumption of 1,007,000 MBtu, a reduction of an additional 55,000 MBtu would meet the 20% reduction goal from FY 75 to FY 85. As previously stated, a 60,000 MBtu reduction would permit USAGH to meet the currently established goal of 1,020,000 MBtu for all installations.

Since the current assigned goal for USAGH covers all installations with no further breakdown by individual installation, it has been assumed for purposes of this study that a 20% reduction of these 4 study installations from FY 75 to FY 85 would be a desirable and reasonable target.




PAST ENERGY CONSUMPTION



FIGURE A

This would also permit USAGH to meet its FY 85 goal even if the other installations have only nominal or no reduction in energy consumption between now and FY 85.

A review of individual bases as tabulated in Table I shows the comparative reduction between bases:

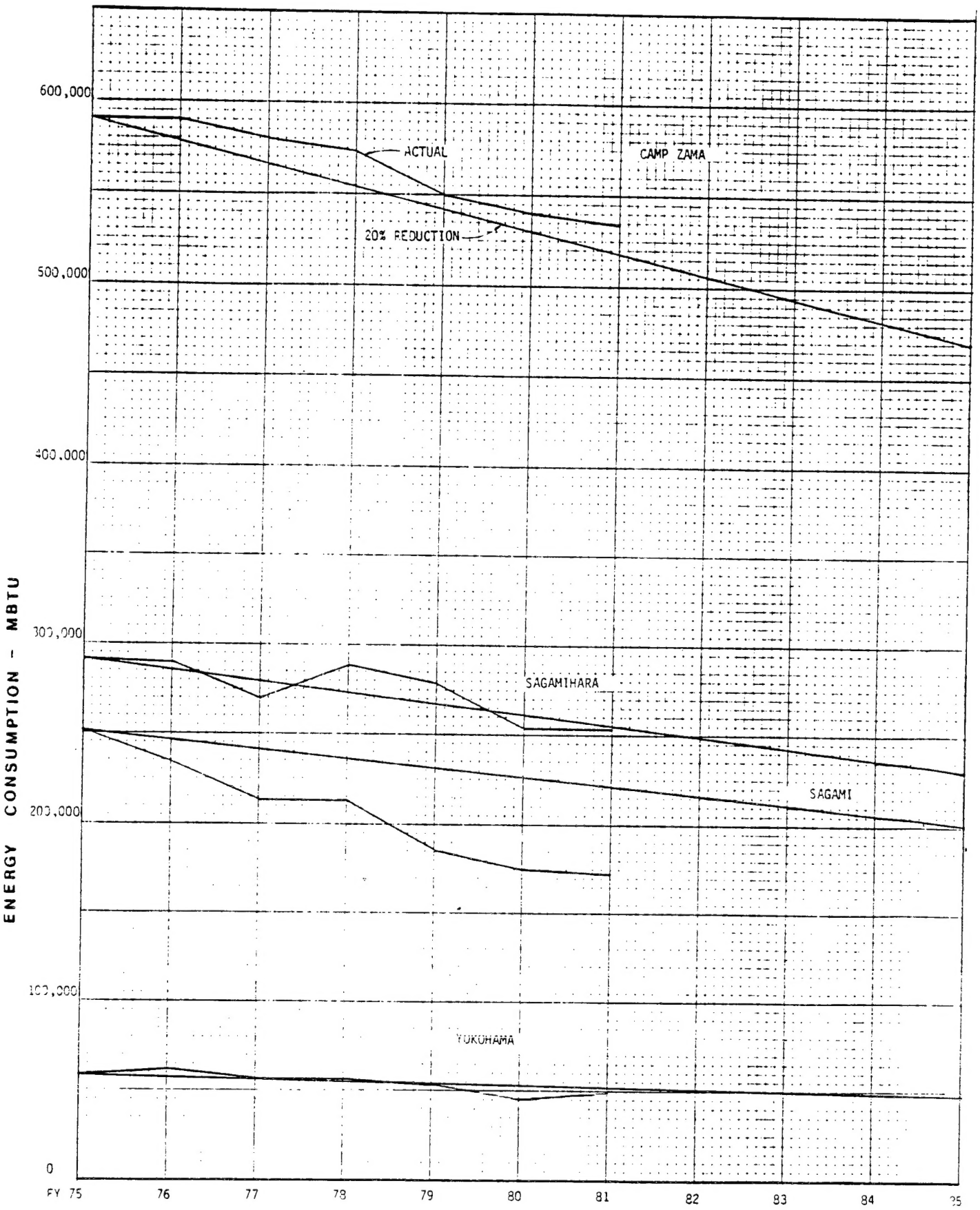
TABLE I

COMPARISON OF ENERGY CONSUMPTION & REDUCTION BY INSTALLATIONS

| | FY 75 (MBtu) | FY 81 (MBtu) | % Reduction | FY85 Goal* (MBtu) | Required Reduction (MBtu) |
|---|---|---|---|---|---|
| Zama | 588,277 | 531,942 | 9.6 | 470,622 | 61,320 |
| SDHA | 292,037 | 253,079 | 13.3 | 233,630 | 19,449 |
| Sagami | 251,363 | 172,971 | 31.2 | 201,090 | -28,119 |
| YND | 59,151 | 49,364 | 16.5 | 47,321 | 2,043 |
| TOTAL | 1,190,828 | 1,007,356 | 15.4 | 952,663 | 54,693 |

*Based on 20% reduction from FY 75 to FY 85.

From the above tabulation, it can be seen that Sagami has already met its FY 85 target and YND is only 4% away from meeting its target with 4 years remaining. SDHA has reduced its energy consumption over the past 6 years by 13% and thus is slightly ahead of schedule in meeting its target. Camp Zama, the largest energy consumer, has a 10% reduction over the past 6 years and therefore has the most "catching up" to do. (See Figure B.) Collectively, the reduction through FY 81 is 15% as compared to the required 12% to stay even with the schedule.




ENERGY CONSUMPTION BY INSTALLATION



FIGURE B

## 2.0 EXISTING ENERGY CONSUMPTION

### 2.1 Source Energy Consumption

The two basic sources of energy consumed are fuel oil (diesel), used primarily for central heating plants, and electric power procured from Tokyo Electric Power Co., Inc. Since FY 75, there has been a steady decline in total energy consumption with fuel oil consumption contributing to most of the reduction. Electric power consumption has remained about the same since FY 75 with annual variations generally attributable to climatic conditions. (See Table II.)

TABLE II

FUEL OIL & ELECTRIC POWER CONSUMPTION

FUEL OIL (GALLON)

| | FY 75 | FY 79 | FY 80 | FY 81 |
|---|---|---|---|---|
| Camp Zama | 2,403,000 | 2,226,000 | 2,138,000 | 2,022,000 |
| Sagamihara | 1,152,000 | 1,207,000 | 1,088,000 | 1,047,000 |
| Sagami Depot | 1,363,000 | 1,002,000 | 970,000 | 930,000 |
| Yokohama | 262,000 | 221,000 | 183,000 | 204,000 |
| TOTAL | 5,180,000 | 4,656,000 | 4,379,000 | 4,203,000 |

ELECTRIC POWER (KWH)

| | FY 75 | FY 79 | FY 80 | FY 81 |
|---|---|---|---|---|
| Camp Zama | 19,814,000 | 20,911,000 | 20,984,000 | 21,688,000 |
| Sagamihara | 10,307,000 | 9,577,000 | 8,880,000 | 9,301,000 |
| Sagami Depot | 4,117,000 | 4,113,000 | 3,668,000 | 3,793,000 |
| Yokohama | 1,973,000 | 1,932,000 | 1,755,000 | 1,827,000 |
| TOTAL | 36,211,000 | 36,533,000 | 35,287,000 | 36,604,000 |

During the past 3 fiscal years; i.e., FY 79, 80 and 81, the total energy consumed has dropped each year, but the cost has increased tremendously due to increased energy costs. For example, the cost of fuel oil increased from 45¢/gal. in FY 79 to $1.37/gal. in FY 81 and electric power increased from 6.1¢/KWH to 11¢/KWH. (See Table III.)

## TABLE III

ANNUAL CONSUMPTION & COST

| | FUEL OIL | | | ELECTRIC POWER | | | Total |
|---|---|---|---|---|---|---|---|
| | Gals. | Cost/Gal. | Amount | KWH(000) | Cost/KWH | Amount | Cost |
| ZAMA | | | | | | | |
| FY79 | 2,225,390 | $0.445 | $ 999,420 | 20,911 | $0.061 | $1,275,570 | $2,275,000 |
| FY80 | 2,138,630 | 1.29 | 2,758,800 | 20,984 | 0.097 | 2,035,450 | 4,794,000 |
| FY81 | 2,021,350 | 1.37 | 2,769,930 | 21,688 | 0.11 | 2,385,680 | 5,156,000 |
| SDHA | | | | | | | |
| FY79 | 1,206,550 | $0.449 | $ 541,740 | 9,578 | $0.061 | $ 584,260 | $1,126,000 |
| FY80 | 1,088,150 | 1.29 | 1,403,710 | 8,880 | 0.097 | 861,360 | 2,265,000 |
| FY81 | 1,046,790 | 1.37 | 1,434,100 | 9,301 | 0.11 | 1,023,110 | 2,457,000 |
| SAGAMI | | | | | | | |
| FY79 | 1,002,400 | $0.449 | $ 450,080 | 4,113 | $0.061 | $ 250,890 | $ 701,000 |
| FY80 | 970,250 | 1.29 | 1,251,620 | 3,680 | 0.097 | 356,960 | 1,609,000 |
| FY81 | 930,050 | 1.37 | 1,274,170 | 3,793 | 0.11 | 417,230 | 1,691,000 |
| YND | | | | | | | |
| FY79 | 221,450 | $0.449 | $ 99,430 | 1,932 | $0.061 | $ 117,850 | $ 217,000 |
| FY80 | 182,560 | 1.29 | 235,500 | 1,755 | 0.097 | 170,240 | 406,000 |
| FY81 | 203,740 | 1.37 | 279,120 | 1,822 | 0.11 | 200,420 | 480,000 |

TOTAL ANNUAL COST

| | FY79 | FY80 | FY81 |
|---|---|---|---|
| ZAMA | $2,275,000 | $4,794,000 | $5,156,000 |
| SDHA | 1,126,000 | 2,265,000 | 2,457,000 |
| SAGAMI | 701,000 | 1,609,000 | 1,691,000 |
| YND | 217,000 | 406,000 | 480,000 |
| TOTAL | $4,319,000 | $9,074,000 | $9,784,000 |

## 2.2 Building Group Energy Consumption

Source energy consumption by building groups was analyzed to obtain unit consumption rates on gross square footage of building area. Of the major building groups, the family housing has the highest unit consumption followed by BOQ, community facility, and office groups. The storage and maintenance facility groups generally have low unit consumption and therefore, installations with a large proportion of their building area consisting of these industrial type facilities have lower average unit consumption.

Sagamihara DHA has the highest unit consumption of over 240,000 Btu/sq. ft. of gross building area due to the predominance of the family housing group. Camp Zama, with over 210,000 Btu/sq. ft. energy consumption is the second highest, also due to the predominance of high energy consuming building groups. Sagami Depot and Yokohama ND both have low unit consumptions of 50,000 and 75,000 Btu/sq. ft., respectively, due to the predominance of industrial facilities. Tables IV-A & B show the source energy consumptions for each installation.

Building energy consumption; i.e., usable energy at the building, was also analyzed by building groups to determine unit consumption rates, which does not take into consideration the energy conversion and transmission losses as well as non-building uses of energy. This unit consumption rate thus reflects the estimated energy usage based on operating conditions and physical characteristics of the buildings. Tables V-A & B show the building energy consumed by various building groups as well as the average unit consumption rate for the total base.

# TABLE IV-A

## SOURCE ENERGY CONSUMPTION

### CAMP ZAMA

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 42,640 | 9,880 | 52,520 | 22,650 | 23,165 | 22,040 | 67,855 | 120,375 | 578,132 | 208,210 |
| Comm.Facil. | 35,440 | 21,120 | 56,560 | 13,525 | 10,125 | 8,595 | 32,245 | 88,805 | 372,504 | 238,400 |
| School | 6,910 | 6,250 | 13,160 | 3,190 | 370 | 960 | 4,520 | 17,680 | 92,535 | 191,060 |
| BOQ | 46,170 | 30,840 | 77,010 | 12,380 | 3,190 | 14,115 | 29,685 | 106,695 | 448,227 | 238,040 |
| Storage | 5,290 | - | 5,290 | 2,120 | 140 | - | 2,260 | 7,550 | 188,456 | 40,060 |
| Maint. | 9,570 | 360 | 9,930 | 4,700 | 220 | - | 4,920 | 14,850 | 125,656 | 118,180 |
| Other | 5,070 | 2,850 | 7,920 | 3,480 | 9,755 | 3,550 | 16,785 | 24,705 | 99,212 | 249,010 |
| Fam.Hsg. | 38,600 | 12,220 | 50,820 | 3,955 | 6,935 | 40,950 | 51,840 | 102,660 | 333,344 | 307,970 |
| Sub-Total | 189,690 | 83,520 | 273,210 | 66,000 | 53,900 | 90,210 | 210,110 | 483,320 | 2,238,066 | 215,950 |
| Laundry | | | 24,960 | | | | - | 24,960 | | |
| Boiler Plt. | | | | | | | 10,460 | 10,460 | | |
| Utilities | | | | | | | 13,090 | 13,080 | | |
| Ext. Ltg. | | | | | | | 9,930 | 9,930 | | |
| Sub-Total | | | 24,960 | | | | 33,480 | 58,440 | | |
| TOTAL | | | 298,170 | | | | 243,590 | 541,760 | | |

### SAGAMIHARA DHA

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | - | - | - | - | - | - | - | - | - | - |
| Comm.Facil. | 4,850 | 770 | 5,620 | 2,900 | 680 | 5,500 | 9,080 | 14,700 | 90,800 | 161,890 |
| School | 4,960 | 560 | 5,520 | 2,010 | 100 | - | 2,110 | 7,630 | 62,987 | 121,140 |
| BOQ | 1,030 | 500 | 1,530 | 130 | - | 380 | 510 | 2,040 | 12,237 | 166,710 |
| Storage | 350 | - | 350 | 350 | - | 5,970 | 6,320 | 6,670 | 65,756 | 96,110 |
| Maint. | - | - | - | - | - | - | - | - | - | - |
| Other | 170 | - | 170 | 30 | 170 | - | 200 | 370 | 4,048 | 91,400 |
| Fam. Hsg. | 79,490 | 58,230 | 137,720 | 8,360 | 13,410 | 58,580 | 80,350 | 218,070 | 789,246 | 276,300 |
| Sub-Total | 90,850 | 60,060 | 150,910 | 13,780 | 14,360 | 70,430 | 98,570 | 249,480 | 1,025,083 | 243,380 |
| Laundry | | | | | | | | | | |
| Boiler Plt. | | | | | | | 5,130 | | | |
| Utilities | | | | | | | 2,000 | | | |
| Ext. Ltg. | | | | | | | 2,170 | | | |
| Sub-Total | | | | | | | 9,300 | 9,300 | | |
| TOTAL | | | 150,910 | | | | 107,870 | 258,780 | | |

# TABLE IV-B

## SOURCE ENERGY CONSUMPTION

### SAGAMI DEPOT

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 12,970 | 930 | 13,900 | 6,320 | 1,120 | - | 7,440 | 21,340 | 179,348 | 118,990 |
| Comm.Facil. | 5,250 | 930 | 6,180 | 1,160 | 1,020 | 580 | 2,760 | 8,940 | 97,492 | 91,700 |
| School | - | - | - | - | - | - | - | - | - | - |
| BOQ | 1,320 | 620 | 1,940 | 130 | - | 480 | 610 | 2,550 | 13,196 | 193,240 |
| Storage | 8,600 | - | 8,600 | 1,700 | 100 | - | 1,800 | 10,400 | 1,457,894 | 7,130 |
| Maint. | 32,890 | 930 | 33,820 | 10,980 | 610 | - | 11,590 | 45,410 | 767,038 | 59,200 |
| Other | - | - | - | 240 | 410 | - | 650 | 650 | 20,474 | 31,750 |
| Fam. Hsg. | 17,470 | 9,480 | 26,950 | 1,460 | 2,140 | 10,260 | 13,860 | 40,810 | 121,177 | 336,780 |
| Sub-Total | 78,500 | 12,890 | 91,390 | 21,990 | 5,400 | 11,320 | 38,710 | 130,100 | 2,656,619 | 48,970 |
| Indust. Use | | | 39,790 | | | | - | 39,790 | | |
| Boiler Plt. | | | - | | | | 1,900 | 1,900 | | |
| Utilities | | | | | | | 1,970 | 1,970 | | |
| Ext. Ltg. | | | | | | | 5,300 | 5,300 | | |
| Sub-Total | | | 39,790 | | | | 9,170 | 48,960 | | |
| TOTAL | | | 131,180 | | | | 47,880 | 179,060 | | |

### YOKOHAMA N.D.

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 11,430 | 4,830 | 16,260 | 4,510 | 1,390 | 1,000 | 6,900 | 23,160 | 121,491 | 190,630 |
| Comm. Facil. | 570 | 2,030 | 2,600 | 200 | 10 | - | 210 | 2,810 | 15,903 | 176,700 |
| School | - | - | - | - | - | - | - | - | - | - |
| BOQ | - | - | - | - | - | - | - | - | - | - |
| Storage | 1,190 | - | 1,190 | 1,960 | 110 | - | 2,070 | 3,260 | 314,851 | 10,350 |
| Maint. | 2,860 | - | 2,860 | 5,780 | - | 1,520 | 7,300 | 10,160 | 92,998 | 109,250 |
| Other | 890 | 660 | 1,550 | 130 | 360 | 540 | 1,030 | 2,580 | 9,572 | 269,540 |
| Fam. Hsg. | - | - | - | - | - | - | - | - | - | - |
| Sub-Total | 16,940 | 7,520 | 24,460 | 12,580 | 1,870 | 3,060 | 17,510 | 41,970 | 554,815 | 75,650 |
| Laundry | | | | | | | - | | | |
| Boiler Plt. | | | | | | | 540 | | | |
| Utilities | | | | | | | 580 | | | |
| Ext. Ltg. | | | | | | | 2,240 | | | |
| Sub-Total | | | | | | | 3,360 | 3,360 | | |
| TOTAL | | | | | | | 20,870 | 45,330 | | |

# TABLE V-A

## BUILDING ENERGY CONSUMPTION

### CAMP ZAMA

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 29,500 | 5,640 | 35,140 | 6,665 | 6,816 | 6,485 | 19,966 | 55,106 | 578,132 | 95,300 |
| Comm.Facil. | 21,800 | 8,955 | 30,755 | 3,979 | 2,980 | 2,529 | 9,488 | 40,243 | 372,504 | 108,030 |
| School | 4,250 | 2,650 | 6,900 | 938 | 109 | 283 | 1,330 | 8,230 | 92,535 | 88,940 |
| BOQ | 28,530 | 13,325 | 41,855 | 3,642 | 938 | 4,153 | 8,733 | 50,588 | 448,227 | 112,860 |
| Storage | 3,250 | - | 3,250 | 624 | 41 | - | 665 | 3,915 | 188,456 | 20,770 |
| Maint. | 6,190 | 155 | 6,345 | 1,382 | 65 | - | 1,447 | 7,792 | 125,656 | 62,010 |
| Other | 3,160 | 1,210 | 4,370 | 1,024 | 2,870 | 1,044 | 4,938 | 9,308 | 99,212 | 93,820 |
| Fam.Hsg. | 23,170 | 5,144 | 28,314 | 1,164 | 2,041 | 12,048 | 15,253 | 43,567 | 333,344 | 130,700 |
| Sub-Total | 119,850 | 37,079 | 156,929 | 19,418 | 15,860 | 26,542 | 61,820 | 218,749 | 2,238,066 | 97,740 |
| Laundry | | | 12,610 | | | | - | 12,610 | | |
| Boiler Plt. | | | | | | | 3,078 | 3,078 | | |
| Utilities | | | | | | | 3,850 | 3,850 | | |
| Ext. Ltg. | | | | | | | 2,921 | 2,921 | | |
| Sub-Total | | | 12,610 | | | | 9,849 | 22,459 | | |
| TOTAL | | | 169,539 | | | | 71,669 | 241,208 | | |

### SAGAMIHARA DHA

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU | | | | GRAND TOTAL | GROSS AREA (sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | - | - | - | - | - | - | - | - | - | - |
| Comm. Facil. | 2,770 | 290 | 3,060 | 850 | 200 | 1,620 | 2,670 | 5,730 | 90,800 | 63,100 |
| School | 2,830 | 210 | 3,040 | 590 | 30 | - | 620 | 3,660 | 62,987 | 58,100 |
| BOQ | 590 | 190 | 780 | 40 | - | 110 | 150 | 930 | 12,237 | 76,000 |
| Storage | 200 | - | 200 | 100 | - | 1,750 | 1,850 | 2,050 | 65,756 | 31,200 |
| Maint. | - | - | - | - | - | - | - | - | - | - |
| Other | 100 | - | 100 | 10 | 50 | - | 60 | 160 | 4,048 | 39,530 |
| Fam. Hsg. | 45,350 | 21,930 | 67,280 | 2,460 | 3,950 | 17,240 | 23,650 | 90,930 | 789,246 | 115,210 |
| Sub-Total | 51,840 | 22,620 | 74,460 | 4,050 | 4,230 | 20,720 | 29,000 | 103,460 | 1,025,083 | 100,900 |
| Laundry | | | | | | | - | | | |
| Boiler Plt. | | | | | | | 1,500 | | | |
| Utilities | | | | | | | 590 | | | |
| Ext. Ltg. | | | | | | | 640 | | | |
| Sub-Total | | | | | | | 2,740 | 2,740 | | |
| TOTAL | | | | | | | 31,740 | 106,200 | | |

# TABLE V-B

## BUILDING ENERGY CONSUMPTION

### SAGAMI DEPOT

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 5,610 | 300 | 5,910 | 1,860 | 330 | - | 2,190 | 8,100 | 179,348 | 45,160 |
| Comm. Facil. | 2,270 | 300 | 2,570 | 340 | 300 | 170 | 810 | 3,380 | 97,492 | 34,670 |
| School | - | - | - | - | - | - | - | - | - | - |
| BOQ | 570 | 200 | 770 | 40 | - | 140 | 180 | 950 | 13,196 | 71,990 |
| Storage | 3,720 | - | 3,720 | 500 | 30 | - | 530 | 4,250 | 1,457,894 | 2,910 |
| Maint. | 14,100 | 300 | 14,400 | 3,230 | 180 | - | 3,410 | 17,810 | 767,038 | 23,090 |
| Other | 130 | - | 130 | 70 | 120 | - | 190 | 320 | 20,474 | 15,630 |
| Fam. Hsg. | 7,560 | 3,050 | 10,610 | 430 | 630 | 3,020 | 4,080 | 14,690 | 121,177 | 121,230 |
| Sub-Total | 33,960 | 4,150 | 38,110 | 6,470 | 1,590 | 3,330 | 11,390 | 49,500 | 2,656,619 | 18,630 |
| Indust. Use | | | 12,800 | | | | - | 12,800 | | |
| Boiler Plt. | | | - | | | | 560 | 560 | | |
| Utilities | | | - | | | | 580 | 580 | | |
| Ext. Ltg. | | | - | | | | 1,560 | 1,560 | | |
| Sub-Total | | | 12,800 | | | | 2,700 | 15,500 | | |
| TOTAL | | | 50,910 | | | | 14,090 | 65,000 | | |

### YOKOHAMA N.D.

| | FUEL OIL (MBTU) | | | ELECTRICITY (MBTU) | | | | GRAND TOTAL | GROSS AREA(sf) | BTU/sf |
|---|---|---|---|---|---|---|---|---|---|---|
| | SPACE HTG. | WATER HTG. | TOTAL | LIGHTING | COOLING | OTHER | TOTAL | | | |
| BLDG. | | | | | | | | | | |
| Office | 7,190 | 2,850 | 10,040 | 1,320 | 410 | 290 | 2,020 | 12,060 | 121,491 | 99,270 |
| Comm. Facil. | 360 | 1,200 | 1,560 | 60 | - | - | 60 | 1,620 | 15,903 | 101,870 |
| School | - | - | - | - | - | - | - | - | - | - |
| BOQ | - | - | - | - | - | - | - | - | - | - |
| Storage | 750 | - | 750 | 580 | 30 | - | 610 | 1,360 | 314,851 | 4,320 |
| Maint. | 1,800 | - | 1,800 | 1,700 | - | 450 | 2,150 | 3,750 | 92,998 | 42,470 |
| Other | 560 | 390 | 950 | 40 | 110 | 160 | 310 | 1,260 | 9,572 | 131,630 |
| Fam. Hsg. | - | - | - | - | - | - | - | - | - | - |
| Sub-Total | 10,660 | 4,440 | 15,100 | 3,700 | 550 | 900 | 5,150 | 20,250 | 554,815 | 36,500 |
| Laundry | | | | | | | - | | | |
| Boiler Plt. | | | | | | | 160 | | | |
| Utilities | | | | | | | 170 | | | |
| Ext. Ltg. | | | | | | | 660 | | | |
| Sub-Total | | | | | | | 990 | 990 | | |
| TOTAL | | | | | | | 6,140 | 21,240 | | |

## 3.0 ENERGY CONSERVATION MEASURES DEVELOPED

The four study bases, not unlike most military installations, contain a mixture of a few relatively new buildings sprinkled amongst many older buildings, some of which are pre-WWII construction. The following highlights the general physical condition of the facilities and energy systems together with operating policies that can influence energy consumption.

1. Structures are mostly old, semi-permanent type with very few buildings provided with insulation.
2. All windows are operable types usually double-hung wood or sliding steel.
3. Most of the heating is provided by steam or hot water produced at oil-fired central boiler plants.
4. Cast-iron radiators with manual control valves are the predominant heating units.
5. Steam or hot water distribution systems have mostly been replaced in recent years.
6. Certain segments of the steam distribution system do not have condensate return lines.
7. Package air conditioning equipment are relatively small units and air-cooled.
8. Many buildings are cooled by privately-owned window A/C units.
9. None of the utility services are metered.

Given the above, it is understandable that energy consumption would be relatively high for the climate zone that these bases are located in. Although the base engineering and operating staffs have done an

outstanding job of implementing various types of energy reducing measures, the continuing reduction required by the DA, not only to FY 85 but beyond, at an even faster rate, would dictate that basic improvements to building envelopes and energy systems be made for greater energy efficiency. These types of improvements are costly and, therefore, future energy saving measures can be expected to require major capital investments.

Since the primary objective of this study program is to develop a short-range Basewide Energy System Plan to meet the FY 85 energy goal, an attempt has been made to identify and develop retrofits that are cost-effective and readily implementable. For example, it is easy to install ceiling insulation where there is an existing suspended ceiling. However, to insulate a wall is much more difficult, costly and disruptive to the occupants. Therefore, mostly ceiling insulation projects are identified and proposed.

Another basic consideration of the study was to find practical and economical retrofits that would permit USAGH to continue reducing energy consumption in an orderly and planned basis. There are countless numbers of minor energy conservation measures of all types. Many of them are commonly known and described in any energy literature, and most of them would result in varying magnitudes of actual savings. The base personnel should be and are aware of these types of measures and are actively implementing them on a continuing basis.

Table VI summarizes the various energy saving projects identified and analyzed for each installation. Appropriate DD Form 1391s have been prepared and submitted for all projects, including supporting documents.

| CAMP ZAMA | | | | | SAGAMIHARA | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PROJECT | Fund-ing | E/C | Savings MBTU | Cost ($000) | PROJECT | Fund-ing | E/C | Savings MBTU | Cost ($000) |
| FY82 | | | | | FY82 | | | | |
| 1. Elect.Hot Wtr. Heaters | OMA | 96 | 1,115 | 12 | 1. Shower Flow Restrictor (FH) | OMA | 51 | 1,660 | 33 |
| 2. Shower Flow Restrict.BOQ | OMA | 83 | 1,640 | 20 | 2. Thermostatic Radiator Valves | OMA | 19 | 380 | 20 |
| 3. Shower Flow Restrict.(FH) | OMA | 73 | 880 | 12 | 3. Door Weatherstrip (FH) | OMA | 18 | 1,200 | 67 |
| 4. HHW Temp.Control-BP 134 | OMA | 30 | 1,500 | 51 | | | | | |
| 5. Door Weatherstrip (FH) | OMA | 19 | 570 | 29 | | | | | |
| 6. HHW Temp.Control - Heat Exchg. | OMA | 14 | 1,260 | 89 | | | | | |
| 7. Repl. Int.HHW Piping-Bldgs. 101/102 | OMA | 8 | 9,000 | 1,203 | | | | | |
| Sub-Total | | | (15,965) | | Sub-Total | | | (3,240) | |
| FY83 | | | | | FY83 | | | | |
| 1. Ceiling Insul.(FH)Genls/Sgm Hills | OMA | 16 | 1,250 | 77 | 1. HHW Temp. Control - BP134 | OMA | 37 | 3,000 | 81 |
| 2. Ceiling Insul.(FH) 900 Blk/Sgm Hill | OMA | 8 | 760 | 93 | 2. Zone Temp. Controls | OMA | 15 | 920 | 60 |
| 3. Ceiling Insul.(FH) Chapel Hill | OMA | 7 | 670 | 93 | 3. Ceiling Insulation | OMA | 6 | 340 | 54 |
| 4. Repl.Stm.Dist. Sys. | OMA | 7 | 1,200 | 164 | | | | | |
| Sub-Total | | | (3,880) | | Sub-Total | | | (4,260) | |
| FY84 | | | | | FY84 | | | | |
| 1. Repl. Street Lights | MMCA | 8 | 975 | 118 | 1. Ceiling Insulation (FH) | MCA | 12 | 8,530 | 736 |
| 2. Ceiling Insul. | MMCA | 6 | 2,970 | 498 | 2. Replace Street Lights | MMCA | 8 | 870 | 106 |
| 3. Insulation (BOQ's) | MCA | 4 | 2,820 | 753 | | | | | |
| Sub-Total | | | (6,765) | | Sub-Total | | | (9,400) | |
| FY85 | | | | | | | | | |
| 1. Remote Zone Temp.Contr.Sys. | ECIP | 21 | 10,440 | 432 | | | | | |
| 2. Thermostatic Radiator Valves | ECIP | 19 | 4,200 | 224 | | | | | |
| 3. Replace Street Lights | ECIP | 15 | 2,430 | 160 | | | | | |
| 4. Heat Pump Hot Wtr.Htrs (FH) | ECIP | 15 | 4,080 | 280 | | | | | |
| 5. Remote Elect.Equip. Controls | OMA | 13 | 500 | 38 | | | | | |
| 6. Insulation Bldgs. 101/102 | MCA | 4 | 3,240 | 931 | | | | | |
| 7. Central Refrig.Plt.Bldg. 101/102 | MCA | - | 1,600 | 3,606 | | | | | |
| Sub-Total | | | (26,490) | | | | | | |
| TOTAL | | | 53,100 | | TOTAL | | | 16,900 | |

# TABLE VI

## PROPOSED ENERGY RETROFIT PROJECTS

| Savings MBTU | Cost ($000) | SAGAMI PROJECT | Fund-ing | E/C | Savings MBTU | Cost ($000) | YOKOHAMA NORTH DOCK PROJECT | Fund-ing | E/C |
|---|---|---|---|---|---|---|---|---|---|
| | | FY82 | | | | | FY82 | | |
| 1,660 | 33 | 1. Shower Flow Restrictor (FH) | OMA | 68 | 320 | 5 | 1. Thermo. Radiator Valve | OMA | 33 |
| 380 | 20 | 2. Thermostatic Radiator Valves | OMA | 42 | 1,650 | 39 | | | |
| 1,200 | 67 | 3. Door Weatherstrip (FH) | OMA | 24 | 260 | 11 | | | |
| (3,240) | | Sub-Total | | | (2,230) | | Sub-Total | | |
| | | FY83 | | | | | FY83 | | |
| 3,000 | 81 | 1. Zone Temp. Controls | OMA | 75 | 6,730 | 90 | 1. Zone Temp. Control | OMA | 35 |
| 920 | 60 | 2. Replace Street Lights | OMA | 16 | 630 | 38 | 2. Replace Street Lights | OMA | 16 |
| 340 | 54 | 3. Ceiling Insulation(FH)Blks 80/90 | OMA | 9 | 520 | 56 | 3. Ceiling Insulation | OMA | 7 |
| | | 4. Repl.Stm.Dist.Sys(FH)Blk 70 | OMA | 8 | 1,825 | 219 | | | |
| (4,260) | | Sub-Total | | | (9,705) | | Sub-Total | | |
| | | FY84 | | | | | FY84 | | |
| 8,530 | 736 | 1. Ceiling Insul. (FH) Blk 70 | MMCA | 8 | 1,070 | 139 | 1. Suspended Ceiling & Insul-Bldg. 347 | OMA | 7 |
| 870 | 106 | 2. Ceiling Insulation | MMCA | 7 | 1,770 | 245 | | | |
| (9,400) | | Sub-Total | | | (2,840) | | Sub-Total | | |
| | | | | | | | FY85 | | |
| | | | | | | | 1. Ceiling Insul - Bldg. 200 | OMA | 5 |
| | | | | | | | Sub-Total | | |
| 6,900 | | TOTAL | | | 14,775 | | TOTAL | | |

(2)

# TABLE VI

## PROPOSED ENERGY RETROFIT PROJECTS

| ost 000) | YOKOHAMA NORTH DOCK<br>PROJECT | Fund-ing | E/C | Savings MBTU | Cost ($000) |
|---|---|---|---|---|---|
| | FY82 | | | | |
| 5 | 1. Thermo. Radiator Valve | OMA | 33 | 1,120 | 34 |
| 39 | | | | | |
| 11 | | | | | |
| | Sub-Total | | | (1,120) | |
| | FY83 | | | | |
| 90 | 1. Zone Temp. Control | OMA | 35 | 1,655 | 47 |
| 38 | 2. Replace Street Lights | OMA | 16 | 1,090 | 67 |
| 56 | 3. Ceiling Insulation | OMA | 7 | 310 | 43 |
| 219 | | | | | |
| | Sub-Total | | | (3,055) | |
| | FY84 | | | | |
| 39 | 1. Suspended Ceiling & Insul-Bldg. 347 | OMA | 7 | 420 | 59 |
| 45 | | | | | |
| | Sub-Total | | | (420) | |
| | FY85 | | | | |
| | 1. Ceiling Insul. - Bldg. 200 | OMA | 5 | 425 | 80 |
| | Sub-Total | | | (425) | |
| | TOTAL | | | 5,020 | |

(3)

## 4.0 ENERGY AND COST SAVINGS

### 4.1 Projected Annual Energy Savings

In addition to the proposed retrofit projects identified from the EEAP study, a tabulation of existing FY 82 funded and unfunded projects, as well as those projects for which funding applications have been submitted, are shown in composite form in Table VII. The breakdown of the projected annual consumption by fuel oil and electric power is shown in Table VIII. Using the energy consumption figures of FY 81 as the base, or beginning point, the annual savings for all existing and proposed projects are taken into consideration and their effects on total consumption developed as projected consumptions for FY 82 through FY 86.

The projected annual consumption for each installation by fiscal year is plotted in Figure C. The projected FY 85 consumption for all 4 installations will be below the 20 percent reduction from FY 75 and also permit the FY 85 goal for USAGH to be met. This will provide flexibility for USAGH in deferring certain projects if demand for other non-energy projects have higher priority.

It should be noted that there are many projects in which E/C ratio is greater than 13, but due to the estimated costs being less than $100,000, they do not qualify for ECIP funding. These projects have been indicated for OMA funding and programmed for earlier years beginning in FY 82. ECIP projects are all programmed for FY 85 funding since it takes 3 years after approval to obtain these funds.

| CAMP ZAMA | Savings MBTU | Total Consumption MBTU |
|---|---|---|
| FY81 CONSUMPTION | | 531,940 |
| • Projects Completed in FY81 | | |
| Exist. FY81 Proj. | 830 | |
| PROJECTED FY82 CONSUMPTION | | 531,110 |
| • Projects Completed in FY82 | | |
| Exist. FY81 Proj. | 800 | |
| Funded FY82 " | 3,730 | |
| Proposed " " | 4,205 | |
| TOTAL SAVINGS | 8,735 | |
| PROJECTED FY83 CONSUMPTION | | 522,375 |
| • Projects Completed in FY83 | | |
| Funded FY82 Proj. | 2,600 | |
| Unfunded " " | 9,000 | |
| Proposed FY83 " | 3,880 | |
| TOTAL SAVINGS | 15,480 | |
| PROJECTED FY84 CONSUMPTION | | 506,895 |
| • Projects Completed in FY84 | | |
| Unfunded FY84 Proj. | 5,450 | |
| Proposed " " | 6,765 | |
| TOTAL SAVINGS | 12,215 | |
| PROJECTED FY85 CONSUMPTION | | 494,680 |
| • Projects Completed in FY85 | | |
| Proposed FY85 ECIP Proj. | 21,150 | |
| " " Proj. | 5,340 | |
| TOTAL SAVINGS | 26,490 | |
| PROJECTED FY86 CONSUMPTION | | 468,190 |

| SAGAMIHARA D-A | Savings MBTU | Total Consumption MBTU |
|---|---|---|
| FY81 CONSUMPTION | | 253,080 |
| • Projects completed in FY81 | -- | |
| PROJECTED FY82 CONSUMPTION | | 253,080 |
| • Projects Completed in FY82 | | |
| Exist. FY81 Proj. | 1,750 | |
| Proposed " " | 3,240 | |
| TOTAL SAVINGS | 4,990 | |
| PROJECTED FY83 CONSUMPTION | | 248,090 |
| • Projects Completed in FY83 | | |
| Unfunded FY82 Proj. | 4,000 | |
| Proposed FY83 " | 4,260 | |
| TOTAL SAVINGS | 8,260 | |
| PROJECTED FY84 CONSUMPTION | | 239,830 |
| • Projects Completed in FY84 | | |
| Unfunded FY83 Proj. | 21,700 | |
| Proposed FY84 | 9,400 | |
| TOTAL SAVINGS | 31,100 | |
| PROJECTED FY85 CONSUMPTION | | 208,730 |

(1)

## TABLE VII

## PROJECTED ANNUAL ENERGY CON

| SAGAMI DEPOT | Savings MBTU | Total Consumption MBTU | YOKOHAMA NO. DOCK | Savings MBTU | Total Consumption MBTU |
|---|---|---|---|---|---|
| FY81 CONSUMPTION | | 172,970 | FY81 CONSUMPTION | | 49,360 |
| • Projects Completed in FY81 | -- | | • Projects Completed in FY81 | -- | |
| PROJECTED FY82 CONSUMPTION | | 172,970 | PROJECTED FY82 CONSUMPTION | | 49,360 |
| • Projects Completed in FY82 | | | • Projects Completed in FY82 | | |
| Funded FY81 Proj. | 390 | | Funded FY82 Proj. | 80 | |
| Funded FY82 " | 3,060 | | Proposed FY82 " | 1,120 | |
| Proposed FY82 " | 2,230 | | | | |
| TOTAL SAVINGS | 5,680 | | TOTAL SAVINGS | 1,200 | |
| PROJECTED FY83 CONSUMPTION | | 167,290 | PROJECTED FY83 CONSUMPTION | | 48,160 |
| • Projects Completed in FY83 | | | • Projects Completed in FY83 | | |
| Proposed FY83 Proj. | 9,705 | | Proposed FY83 | 3,055 | |
| PROJECTED FY84 CONSUMPTION | | 157,585 | PROJECTED FY84 CONSUMPTION | | 45,105 |
| • Projects Completed in FY84 | | | • Projects Completed in FY84 | | |
| Unfunded FY84 Proj. | 4,825 | | Proposed FY84 Proj. | 420 | |
| Proposed FY84 " | 2,840 | | | | |
| TOTAL SAVINGS | 7,665 | | | | |
| PROJECTED FY85 CONSUMPTION | | 149,920 | PROJECTED FY85 CONSUMPTION | | 44,685 |
| | | | • Projects Completed in FY85 | | |
| | | | Proposed FY85 Proj. | 425 | |
| | | | PROJECTED FY86 CONSUMPTION | | 44,260 |

(2)

## TABLE VII

## PROJECTED ANNUAL ENERGY CONSUMPTION

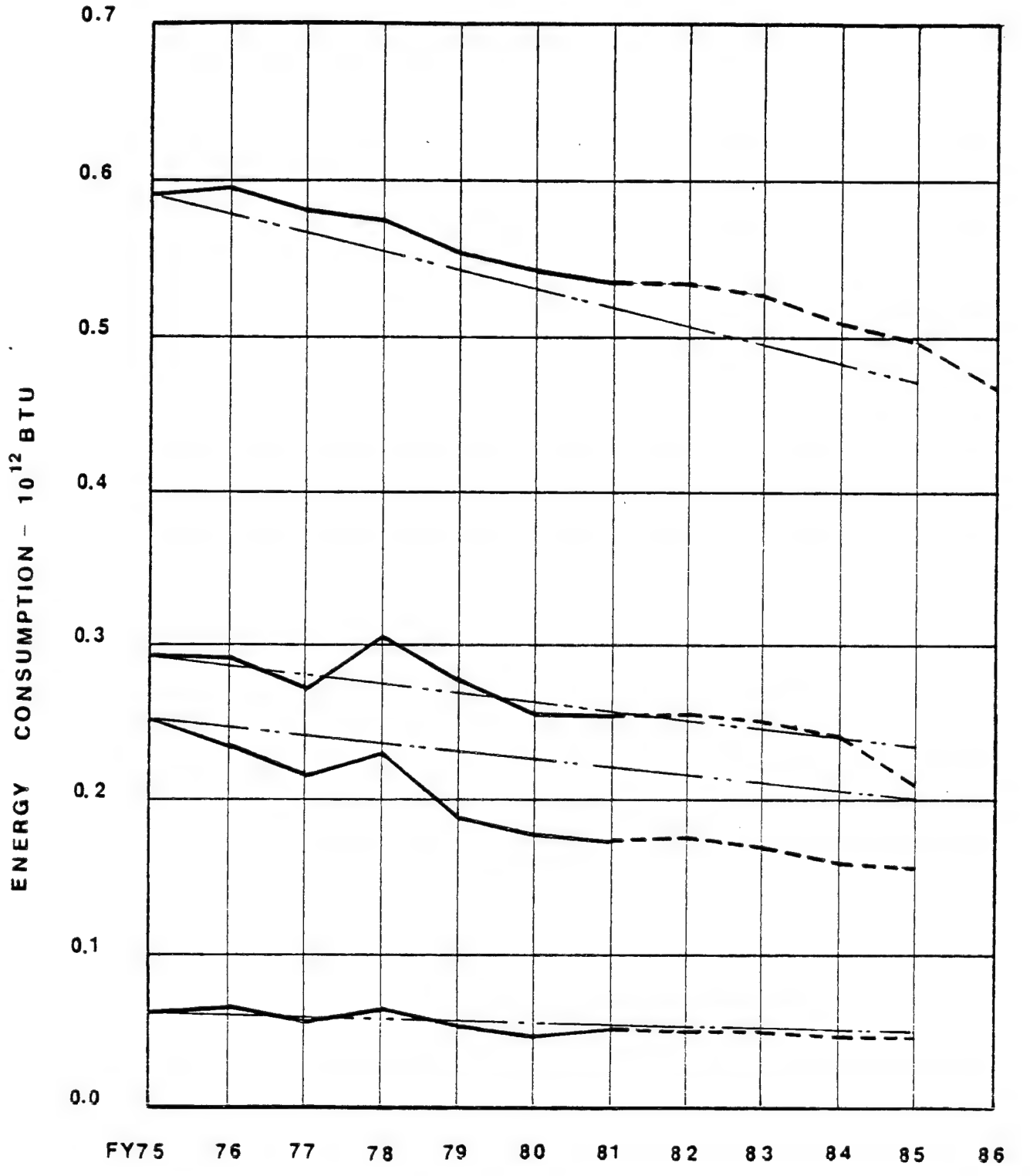
| YOKOHAMA NO. DOCK | Savings MBTU | Total Consumption MBTU | Total Consumption Four Installations MBTU |
|---|---|---|---|
| CONSUMPTION | | 49,360 | 1,007,350 |
| jects Completed in FY81 | -- | | |
| CTED FY82 CONSUMPTION | | 49,360 | 1,006,520 |
| jects Completed in FY82 | | | |
| ed FY82 Proj. | 80 | | |
| osed FY82 " | 1,120 | | |
| TOTAL SAVINGS | 1,200 | | |
| TED FY83 CONSUMPTION | | 48,160 | 985,915 |
| ects Completed in FY83 | | | |
| osed FY83 | 3,055 | | |
| TED FY84 CONSUMPTION | | 45,105 | 943,415 |
| cts Completed in FY84 | | | |
| osed FY84 Proj. | 420 | | |
| ED FY85 CONSUMPTION | | 44,685 | 893,015 |
| cts Completed in FY85 | | | |
| sed FY85 Proj. | 425 | | |
| TED FY86 CONSUMPTION | | 44,260 | 871,100 |

(3)

# TABLE VIII

PROJECTED ANNUAL CONSUMPTION FOR FUEL OIL & ELECTRIC POWER (MBtu)

| | FY81 | FY82 | FY83 | FY84 | FY85 | FY86 |
|---|---|---|---|---|---|---|
| ZAMA | | | | | | |
| Fuel Oil | 280,450 | 279,620 | 271,135 | 257,095 | 246,335 | 229,740 |
| Elect. | 251,580 | 251,580 | 251,330 | 250,170 | 248,715 | 238,820 |
| Total | 532,030 | 531,200 | 522,465 | 507,265 | 495,050 | 468,560 |
| SDHA | | | | | | |
| Fuel Oil | 145,220 | 145,220 | 140,230 | 132,015 | 102,655 | 102,655 |
| Elect. | 107,890 | 107,890 | 107,890 | 107,845 | 106,105 | 106,105 |
| Total | 253,110 | 253,110 | 248,120 | 239,800 | 208,760 | 208,760 |
| SAGAMI | | | | | | |
| Fuel Oil | 128,990 | 128,990 | 123,310 | 114,275 | 111,690 | 111,690 |
| Elect. | 44,000 | 44,000 | 44,000 | 43,330 | 43,075 | 43,075 |
| Total | 172,990 | 172,990 | 167,310 | 157,605 | 154,765 | 154,765 |
| YND | | | | | | |
| Fuel Oil | 28,290 | 28,290 | 27,170 | 25,230 | 24,910 | 24,560 |
| Elect. | 21,140 | 21,140 | 21,140 | 20,025 | 19,925 | 19,850 |
| Total | 49,430 | 49,430 | 48,310 | 45,255 | 44,835 | 44,410 |
| TOTAL | | | | | | |
| Fuel Oil | 582,950 | 582,120 | 561,845 | 528,615 | 485,590 | 468,645 |
| Elect. | 424,610 | 424,610 | 424,360 | 421,370 | 417,820 | 407,850 |
| Total | 1,007,560 | 1,006,730 | 986,205 | 949,985 | 903,410 | 876,495 |




PAST & PROJECTED ENERGY CONSUMPTION BY INSTALLATION



FIGURE C

## 4.2 Projected Cost Savings

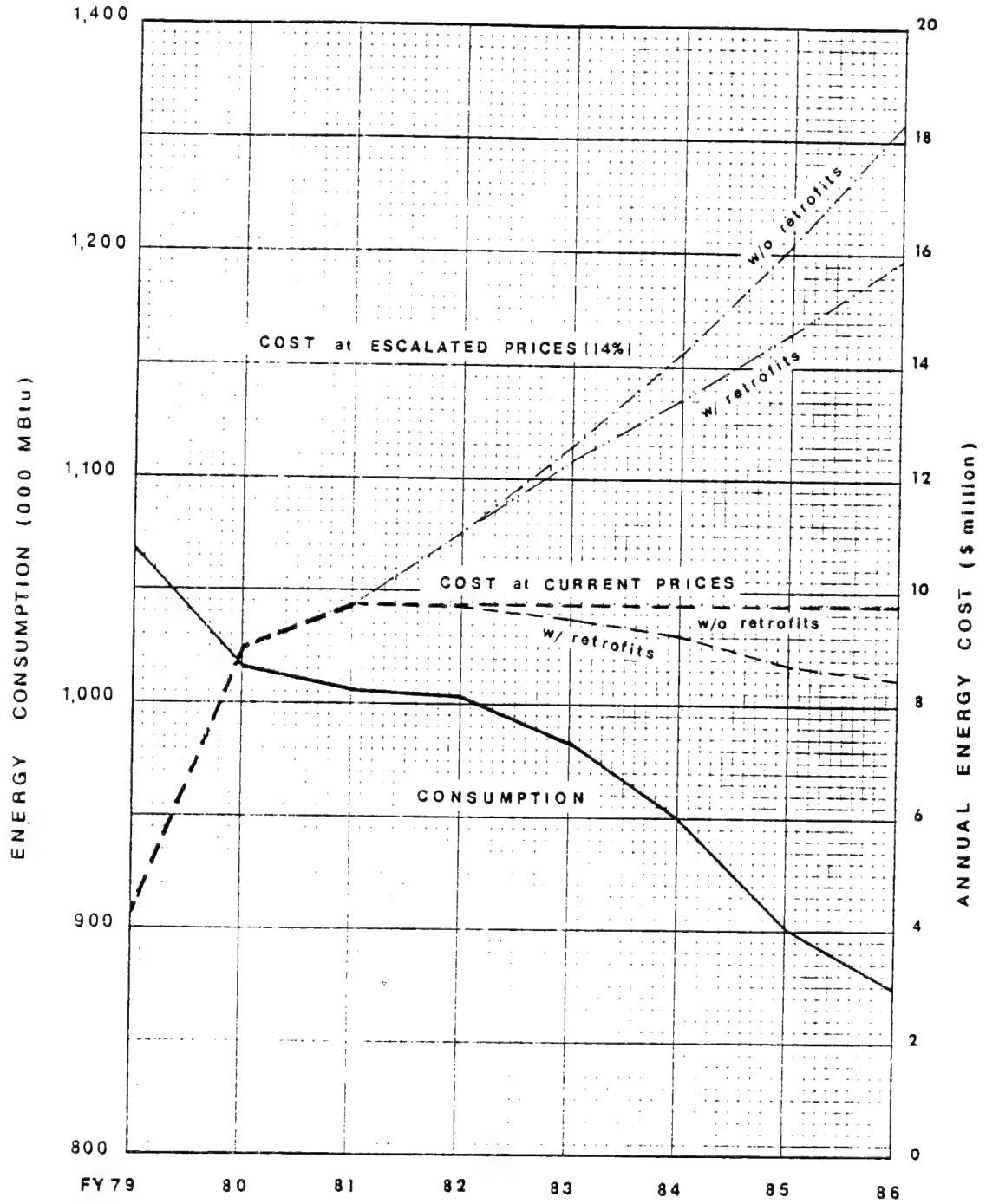
Although energy consumptions have been reduced since FY 75, energy cost has continuously increased due to increasing rates of energy cost. With a projected reduction in energy consumption of approximately 10 percent between FY 81 and FY 85, the energy cost savings would be approximately $1-million assuming constant energy cost rates. This reduction in energy consumption is approximately 2.5 percent per year so any annual increase in energy cost rates greater than this amount would naturally result in increased total cost of energy. Figure D graphically portrays the range of projected energy costs between constant rates and increasing rates at 14 percent per year.

If all energy retrofit projects were implemented as shown on Table VI, the annual energy savings using FY 81 as the base are shown in Table IX.

TABLE IX

ANNUAL ENERGY COST SAVINGS

| | Fuel Oil | | Electric | | | |
|---|---|---|---|---|---|---|
| | Annual Consumption(MBTU) | Annual Cost | Annual Consumption(MBTU) | Annual Cost | Total Cost | Savings (From FY81) |
| FY 81 | 582,950 | $5,758,000 | 424,610 | $4,026,000 | $9,784,000 | |
| FY 82 | 582,120 | 5,750,000 | 424,610 | 4,026,000 | 9,776,000 | $ 8,000 |
| FY 83 | 561,845 | 5,550,000 | 424,360 | 4,024,000 | 9,574,000 | 210,000 |
| FY 84 | 528,615 | 5,221,000 | 421,370 | 3,996,000 | 9,217,000 | 567,000 |
| FY 85 | 485,590 | 4,796,000 | 417,820 | 3,962,000 | 8,758,000 | 1,026,000 |




PROJECTED ENERGY CONSUMPTION AND COSTS

FIGURE D

## 5.0 PAST ENERGY CONSERVATION MEASURES

Past energy conservation efforts by USAGH have obviously been effective in reducing energy consumption to a level which nearly matches the 1985 goal. These efforts have been accomplished basically in two areas, first by the cooperation of the resident and non-resident population of the installations and second, by the various energy conservation measures implemented to date.

As part of the energy conservation program, USAGH has adopted and followed the policies, responsibilities, and procedures for conservation of energy as prescribed in the USAGH Regulation No. 420-44. This regulation is supplemented by USAGH Pamphlet No. 420-44-1 and No. 420-44-2 entitled, "Fuel & Utilities Conservation in Living Quarters" and "Fuel & Utilities Conservation," respectively.

Various energy conservation measures have been implemented since FY 75 which have contributed immeasurably to overall energy reduction. Table X lists the energy conservation projects implemented and/or funded through FY 82 with the dollar value of these projects by installation, as follows:

- o Camp Zama $2,607,000
- o Sagamihara DHA $2,731,000
- o Sagami General Depot $1,046,000
- o Yokohama No. Dock $1,080,000

As can be seen from Table X, the large expenditures have been in repair/replacement of distribution system piping.

| | CAMP ZAMA | Cost ($000) | SAGAMIHARA | Cost ($000) |
|---|---|---|---|---|
| FY75 | Upgrade BPS 501&1028 | 2 | Repl. 5 oil burners BP 134 | 58 |
| | Repl. hot water generator Bldg. 9750 | 2 | Rebrick boilers & smoke flues BP 134 | 18 |
| | Repl. Stm.Distr.Sys. P-1 thru P-4 | 6 | Repl. stm drum insul. & con. FW sys. BP 134 | 2 |
| | | | Repl. pumps & compression BP 134 | 10 |
| FY76 | Repl. 2 Kewance boilers - BP 350 | 52 | Repair combustion chambers BP 134 | 4 |
| | Repair pkg. boilers BP 350 | 3 | | |
| | Repl.HHW & DHW distr. sys. | 216 | | |
| | Rebrick boilers - BP 350 | 22 | | |
| | Adjust fuel burning equip.-all BP's | 4 | | |
| | Interconnect BP 950&350 | 46 | | |
| FY77 | Alter equip. BP 1024 | 35 | Repair windows 67 FHU | 185 |
| | Repair refractory lining-incinerator | 7 | Repair steam traps BP 134 | 3 |
| | Repair & modify stm.piping BP 350 | 5 | Repair arch & front wall of #3 boiler | 19 |
| | | | Repair motor controls BP 134 | 27 |
| FY78 | Install cont.blow-down sys. | 2 | Repair int. htg. piping Blks 200,400&600 | 230 |
| | Repair heat exchangers-264,377&430 | 133 | Repair combustion chamber of #4 boiler | 19 |
| | Repair windows - 54 FHU-Blk 900 | 138 | Replace HHW distr. sys.-front gate area | 201 |
| | Replace condensate tank BP 350 | 15 | " " " " -back gate area | 247 |
| | Repair windows Bldg. 1086 | 2 | " " " " -control area | 220 |
| | Repair smoke stack BP 1028 | 3 | Replace radiators Bldg. 529 | 16 |
| | Repair feedwater sys. BP 350 | 9 | Repair combustion chambers BP 134 | 8 |
| FY79 | Replace hot water generators - 12 BOQ's | 225 | Repair int.htg.piping of FHU-front gate area | 310 |
| | Interconnect BP 771&350 | 15 | " " " " " " Central area | 211 |
| | Repair boiler equip. BP 350 | 44 | Repair weather meter assembly BP 134 | 8 |
| | Repair 5 FW motor valves | 1 | Install corrosion control sys. on DHW sys. | 18 |
| FY80 | Repair stm.& HHW distr.sys. | 328 | Replace elect. sys. - BP 134 | 54 |
| | Replace steam traps - Laundry/Dry Clng Plt. | - | Repair comb. chamber BP 134 | 5 |
| | Install thermostatic radiator valves | - | | |
| | Repair comb.chamber & boiler tubes BP 350 | 7 | | |
| | Repair boiler BP 1024 | 3 | | |
| | Replace DHW distr. sys. - SGM Hill area | 22 | | |
| | Replace smoke stack BP 501 | 4 | | |
| FY81 | Install new boiler BP 1028 | 80 | Replace chemical feeders BP 134 | 10 |
| | Install warm-air furnace - 128 FHU | - | | |
| | Replace chemical feeders BP 134&350 | 17 | | |
| | Repair stm.htg.sys. Bldg. 201 | 51 | | |
| | Chemical cleaning of pkg. boilers | 16 | | |
| FY82 | Replace windows - 91 FHU Chapel Hill | 335 | Replace HHW/DHW bldg. service valves | 106 |
| | " " 24 FHU SGM Hill | 50 | Replace int.HHW/DHW piping (non-FH bldgs.) | 50 |
| | Repl.insul.on Blr.breeching & heat Xchgrs | 27 | | |
| | Alter Bldg. 202 | 17 | | |
| | Alter/repair Bldg. 322 | 67 | | |
| | Replace fuel oil tank - Gen. Plt. 133 | 8 | | |
| | Repair HHW & DHW distr.sys. | 350 | | |
| | Alter/repair Commissary Annex Bldg. 680 | 105 | | |
| | Alter/repair Bldg. 315 | 124 | | |
| FY83 | | | Replace windows 40 FHU Area "F" | 278 |
| | | | " " 56 " Area "G" | 414 |

(1)

TABLE X

PAST ENERGY RETROFIT PROJECTS

| ost 000) | SAGAMI | Cost ($000) | YOKOHAMA N.D. | Cost ($000) |
|---|---|---|---|---|
| 38 | | | Interconn. BP 308 & 324 | 5 |
| 18 | | | | |
| 2 | | | | |
| 10 | | | | |
| 4 | Repair interior htg piping - 9 Bldgs. Blk 70 | 27 | Repair stm. piping Bldgs. 91-S6 & 91-S10 | 6 |
| | Install ceiling insul - FH units | 4 | Repair boiler equip. BP 81-S11 | 28 |
| | | | Adjust fuel burning equip. all BP's | 3 |
| 5 | Repair BP 214 & 324 & stm.distr.sys. | 57 | Repl. 6 oil burners & rebrick boilers BP17-41 | 230 |
| 3 | Replace 6 oil burners and rebrick Boilers BP 174-1 | 128 | | |
| 9 | | | | |
| 7 | | | | |
| 0 | Repair stm.distr.sys. - Fam. Hsg. area | 126 | Repair stm. distr. sys. | 214 |
| 9 | | | Install cont. blowdown sys. | 1 |
| 1 | | | Alter fuel burning equip. BP 214 | 7 |
| 7 | | | " " " " BP 324 | 3 |
| 0 | | | Repair windows 28 FHU | 78 |
| 6 | | | Repair boiler equip. - BP 324 | 4 |
| 8 | | | | |
| 0 | Install waste heat recovery sys. BP 174-1 | 8 | Repair BP 71-S11 | 28 |
| 1 | | | Replace interior htg.piping 7 Bldgs.Blks 90-891 | 178 |
| 3 | | | Repair stm. distr. sys. | 270 |
| 8 | | | | |
| 4 | Rebrick comb. chamber BP 174-1 | 75 | Replace vacuum pump BP 214 & 324 | 2 |
| 5 | Replace windows 35 FHU Blk. 70 | 138 | Remove top section of smoke stack BP 324 | 1 |
| ) | Repair and upgrade Bldg. 103-S2 | 126 | Chemical cleaning of pkg. boilers | 5 |
| | Install thermostatic radiator valves - 35 FHU | 43 | | |
| 5 | Repair stm. heating piping - 27 FHU | 164 | Replace 250 BBl fuel oil tank BP 214 | 17 |
| ) | Replace windows 25 FHU Blk 90/91 | 56 | | |
| | Replace 7 pumps in stm. distr. sys. | 30 | | |
| | Alter/repair Bldg. 155-S3 Cole Hall | 64 | | |
| | | | | |



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## 6.0 ENERGY MANAGEMENT PLAN

The FY 85 energy goal for USAGH is established for all installations under this command of which these four study installations are part thereof. Consequently, there are no official separate energy goals established for individual installations. However, with the 4 study installations representing over 90% of the total energy consumption for USAGH, its FY 85 goal should be readily attainable by implementing the energy conservation measures identified under this study. Sufficient projects have been developed to permit each installation to exceed its 20% reduction from FY 85 to FY 85 (FY 86 for Camp Zama). However, it should be emphasized that the official goal is established for all USAGH installations collectively and that cost-effectiveness should be the primary criterion in establishing priorities.

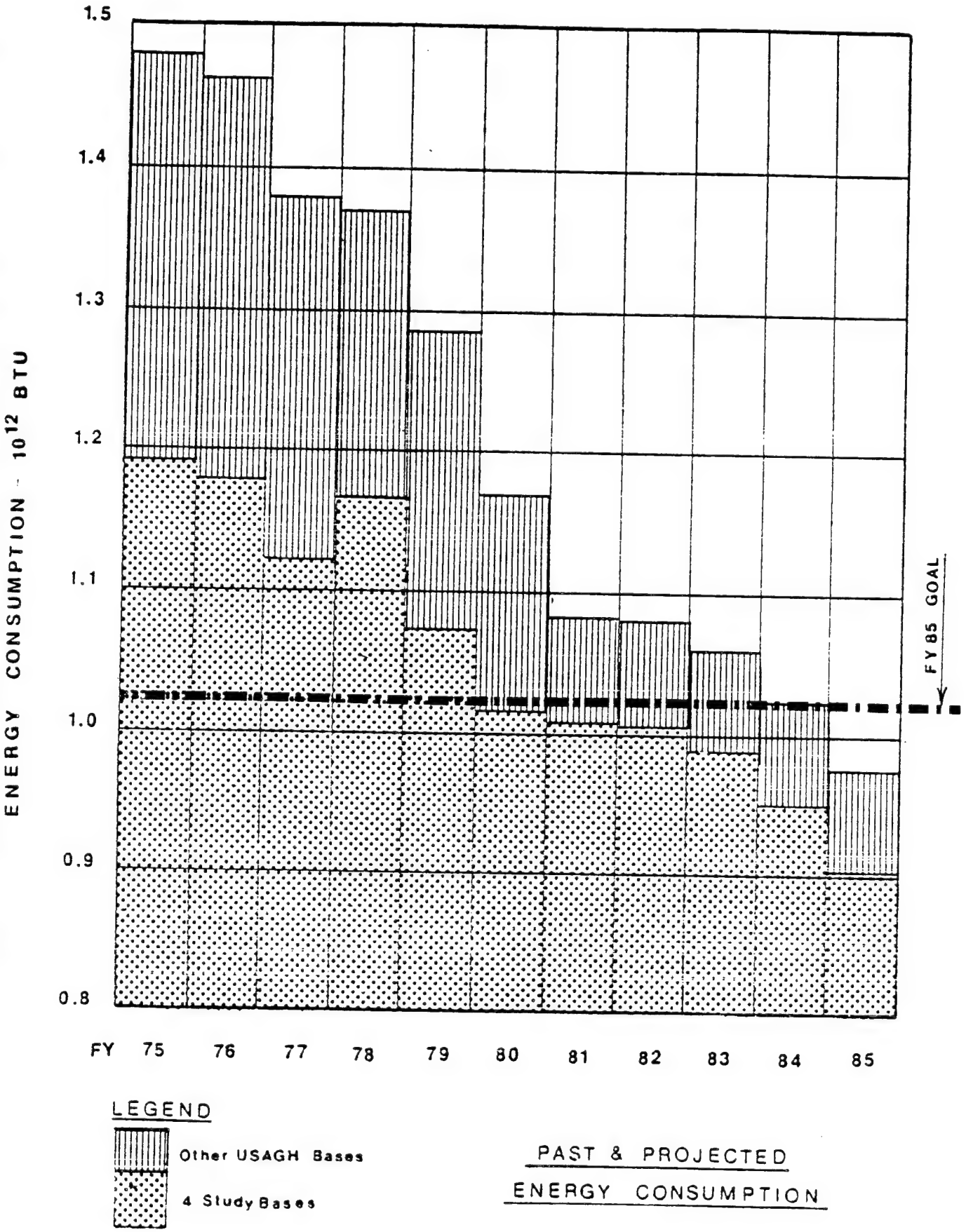
A year-by-year results of implementing current and proposed projects for each installation are shown in Table VII with the resulting projected energy consumption for each fiscal year up to and including FY 86. For Camp Zama, since the ECIP projects can be implemented in FY 85 at the earliest, the resulting impact on energy consumption is necessarily reflected in FY 86.

To reach the 20% reduction for these four installations collectively, a reduction of some 55,000 MBtu from FY 81 is required. The programmed projects, including existing funded projects as well as planned unfunded projects, are projected to reduce energy consumption by over 100,000 MBtu for FY 85 and by some 125,000 MBtu for FY 86 when the ECIP projects are completed at Camp Zama.

As previously stated, the current USAGH goal for FY 85 is $1.02 \times 10^{12}$ Btu. Assuming that the rest of the installations, other than the 4 study bases, have a constant annual energy consumption of $0.73 \times 10^{12}$ Btu through FY 85, then the FY 85 goal for USAGH can be met with the implementation of the proposed retrofit projects as shown in Figure E.

The projected USAGH consumption for FY 85 is $.98 \times 10^{12}$ Btu which is $.04 \times 10^{12}$ below the goal of $1.02 \times 10^{12}$ Btu. This difference represents approximately 4% of the total consumption which is not a significant amount given the variations in annual climatic conditions and other factors influencing energy consumption. Therefore, concurrent with these proposed retrofit projects, current management actions need to be vigorously pursued in the future as well as the continued implementation of no cost/low cost actions by base personnel. Central to successfully reducing future energy consumption would be the continued cooperation of resident and non-resident population in energy conservation, all as described in the Energy Management Plan report.

Various forms of energy conservation opportunities (ECO) were identified and analyzed for cost-effectiveness including both small and large retrofit projects as shown in Table VI. Small projects that are low in cost with relatively high energy savings and can be implemented immediately should be given top priority. Examples of this type of project is the installation of flow restrictors on shower heads and electric water heaters to replace certain heat exchangers served by a relatively long steam line.




PAST & PROJECTED
ENERGY CONSUMPTION

FIGURE E

However, to realize energy reductions that will make a measurable impact on overall energy consumption, those projects with potential for significant savings should also be given high priority. This type of project would include the improvement of building envelope with ceiling insulation and the control of indoor temperatures in buildings during unoccupied hours.

Buildings with suspended ceilings that are easy to install insulation should be given top priority. Although these projects may or may not have an E/C ratio of 13, they can be quickly done once funding is authorized with benefits accuring immediately.

Most non-residential buildings are occupied during normal working hours for 5 days a week which represents only one-third of the total time. The remaining two-thirds of the time which is unoccupied does not require the normal heating. However, with no means of controlling the heating system, heating continues for 24 hours every day which results in a tremendous amount of wasted energy.

Generally, daytime heating with internal heat gain from lighting, people and solar loads plus the warmer daytime temperature consumes only 25% of the all-day heating load. By setting back the indoor temperature during unoccupied periods, heating loads can be reduced by 40%

The projects have been prioritized in Table VI based generally on the E/C ratio and time required to implement projects. However, each project should be evaluated by taking into consideration various other

factors. Some of these factors would include, but not be limited to, the following:

- Availability of funding
- Need of competing non-energy projects
- Future use of facility
- Planned or future repair/rehabilitation of facility
- Level of energy reduction required to meet Army goal

After completion of each year's programming of projects, the remaining list of retrofit projects should be reviewed and re-prioritized as required.

The past energy conservation program of USAGH has resulted in outstanding results as evidenced by the year-to-year reduction in energy consumption. The proposed retrofit projects identified from this study should provide sufficient energy reduction to meet the FY 85 goal. However, a continuing effort will be required in all areas of energy conservation to ensure that the FY 85 goal can be met even if some of the retrofit projects should be deferred.

The Energy Management Plan is developed to provide a comprehensive program to guide future energy conservation efforts. In addition to the proposed retrofit projects shown in Table VI, various types of management and operations and maintenance initiatives are contained in the Master Energy Management Plan shown in Table XI.

| | FY 83 | |
|---|---|---|
| Management | o Continue public informational program.<br>o Continue Honshu Conservation Committee activities including Engineer Energy Think Tank.<br>o Review and update USAGH Reg. 420-44 and USAGH Pam. 420-44-1 and 420-44-2.<br>o Continue monitoring space utilization in facilities and determine if activities can be moved. | o Continue for FY 83 |
| No Cost/Low Cost | o Calibrate thermostats and check setting.<br>o Check temp. setting of hot water heating systems.<br>o Review preventive maint. plan and upgrade as required.<br>o Review boiler plant operations to reduce number of boilers on-line and maximize use of efficient boilers.<br>o Monitor electric energy consumption during winter months for non-conforming use of electric heaters.<br>o Monitor DHW consumption served from major heat exchangers to identify possible leaks and wastage.<br>o Install permanent meters in FH areas and monitor energy consumption.<br>o Install permanent electric meters in high energy consumption buildings and monitor.<br>o Caulk openable windows that are never opened.<br>o Install floor vent covers. | o Conduct s oversized replaceme<br>o Conduct s central B HW heater<br>o Investigat achieve t Camp Zama.<br>o Install a results of<br>o Initiate r consumptio |
| Retrofit Projects | o Undertake FY 83 retrofit projects | o Undertake |

TABLE XI

MASTER ENERGY MANAGEMENT PLAN

| FY 84 | FY 85 |
|---|---|
| tinue with management activities outlined FY 83 | o Continue with management activities outlin FY 83. |
| iuct survey of electric motors to identify -sized motors and inefficient motors requiring acement.<br><br>iuct survey of non-resid. DHW service from ral BPs for replacement with individual eaters.<br><br>stigate and implement temporary means to eve temp. set-back in Bldg. 101 and 102 in Zama.<br><br>all addit. meters in FH areas based on lts of installed meters.<br><br>iate remedial measures to reduce electric mption by high energy consumption bldgs. | o Initiate projects to replace electric moto modify electric driven equip. to improve ef ciency.<br><br>o Initiate projects to install individual hot heaters.<br><br>o Conduct study to find alternate means of pr steam for industrial uses in Sagami during months. |
| take FY 84 retrofit projects | o Undertake FY 85 retrofit projects |

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TABLE XI

MASTER ENERGY MANAGEMENT PLAN

| FY 85 |
| --- |
| ıtinue with management activities outlined for 83. |
| tiate projects to replace electric motors or ify electric driven equip. to improve effi- ncy.<br><br>tiate projects to install individual hot water ters.<br><br>duct study to find alternate means of providing ım for industrial uses in Sagami during summer ths. |
| rtake FY 85 retrofit projects |